CLAIMS

What is claimed is:

1. An apparatus for processing a digital data stream from multiple users, comprising:

an initial amplitude estimation unit processing said data stream and producing initial amplitude estimates on a first iteration;

a joint amplitude estimator coupled to said data stream and said initial amplitude estimator, wherein said joint amplitude estimator produces updated amplitude estimates;

a symbol estimator coupled to said data stream, said initial amplitude estimator, and said joint amplitude estimator, wherein said symbol estimator produces a plurality of symbols estimates for each user; and

a bank of decoders coupled to said symbol estimator, producing a plurality of symbol likelihood estimates for each user, wherein said symbol likelihood estimates are iteratively fed back to said symbol estimator and said joint amplitude estimator until a final condition is obtained.

2. The apparatus according to claim 1, wherein said final condition is selected from at least one of the group consisting of: bit error rate metric level and fixed number of iterations.

3. The apparatus according to claim 1, wherein said symbol hypothesis testing module is a member selected from at least one member of the group consisting of: Minimum Mean Squared Error (MMSE), maximum likelihood, M-algorithm, T-algorithm, and Q-algorithm, decorrelating decision-feedback detector (DDFD), improved decorrelating decision-feedback detector (IDDFD), successive interference cancellation (SIC), parallel interference cancellation (PIC) and multi-stage detector; block-iterative interference cancellation, and a deferred decorrelating decision-feedback detector.

4. The apparatus according to claim 1, further comprising an energy detector coupled to said joint amplitude estimator.

5. The apparatus according to claim 1, wherein said bank of decoders are decoders selected from at least one decoder of the group consisting of: Soft-output Viterbi , Maximum A Posteriori , and BCJR.

6. A method for providing initial amplitude estimation for a plurality of user channels, comprising:

separating said user channels into active channels and inactive channels;

processing said inactive channels according to the sub-steps comprising:

applying a bank of filters to said inactive channels for each inactive user;

squaring an output from said bank of filters;

summing an output from said squaring operation; and

calculating an average bias estimate from an output of said summing; and

processing said active channels according to the sub-steps comprising:

applying a bank of filters to said user data of said active channels;

squaring an output from said bank of filters ;

summing an output from said squaring; and

removing said average bias estimate from an output from said summing.

7. The method according to claim 6, said processing said inactive channels further comprising dividing said inactive channels into groups and calculating at least one group average bias estimate.

8. The method according to claim 7, said processing said active channels further comprising dividing said active channels into groups and respectively removing said at least one group average bias estimate.

9. The method according to claim 6, wherein said summers further comprises scaling.

10. The apparatus according to claim 6, wherein said separating said active channel from said inactive channels is performed by an energy detector.

11. An apparatus for processing initial amplitude estimates from a data stream of multiple users, comprising:

an energy detector measuring an energy level of said data stream, wherein said energy detector separates a plurality of active channels from a plurality of inactive channels;

a bank of filters coupled to said inactive channels;

a bank of squaring operators coupled to said bank of filters;

a bank of inactive summers coupled to said squaring operators;

an average bias estimator coupled to said inactive summers calculating an average bias estimate;

a bank of filters coupled to said active channels;

a bank of squaring operators coupled to said bank of filters;

a bank of active summers coupled to said squaring operators; and

a bias removal section coupled to said active summers and said average bias estimator.

12. The apparatus according to claim 11, wherein said inactive channels are divided into groups calculating said average bias estimate for each said group.

13. The apparatus according to claim 12, wherein said active channels are divided into said groups and wherein said bias removal section for each said group removes said average bias estimate for each said corresponding group.

14. A joint amplitude estimator for a data stream from multiple users, comprising:

a data stream from said multiple users divided into a plurality of observation intervals;

a plurality of processing modules coupled to said observation intervals, wherein said processing modules calculates interference cancellation values for each of said users and computes a filter for each of said observation intervals, said filter being applied to said data within said observation interval to compute individual amplitude estimates; and

an amplitude estimation unit which processes said individual amplitude estimates and calculates new amplitude estimates, wherein said new amplitude estimates are iteratively passed back to said processing modules until a final condition is obtained.

15. The joint amplitude estimator according to claim 14, wherein said final condition is selected from at least one of the group consisting of: bit error rate metric level and fixed number of iterations.

16. The joint amplitude estimator according to claim 14, wherein said amplitude estimation unit sums and weighs said individual estimates.

17. The joint amplitude estimator according to claim 14, wherein said observation intervals are based on distinguishing attributes selected from at least one of the group consisting of: time, code, and frequency.

18. The joint amplitude estimator according to claim 14, wherein said filter is calculated for an arbitrary observation interval m as:

$$G_m = \mathbf{B}_m \mathbf{S}_m^H \left(\mathbf{S}_m \chi_m \mathbf{S}_m^H + \sigma_n^2 I \right)^{-1}.$$

19. A method for processing amplitude estimates for a multiuser data stream divided into a plurality of observation intervals, comprising:

computing a filter for each said observation interval of said data stream;

applying interference cancellation to said data stream for each said observation interval;

applying said filter to said data stream for each said observation interval from said interference cancellation to produce individual amplitude estimates for each said observation interval;

computing new amplitude estimates using said individual amplitude estimates; and

passing said new amplitude estimates back to said filter for iterative processing until a final condition is obtained.

20. The method according to claim 19, wherein said computing further comprises summing said individual amplitude estimates and weighing.

21. The method according to claim 19, wherein said final condition is selected from at least from the group consisting of: bit error rate metric level and fixed number of iterations.

22. A turbo-decoding system for joint signal demodulation, comprising:

a data stream from a plurality of users divided into a plurality of observation intervals;

a plurality of symbol processing nodes processing said observation intervals to compute symbol estimates for said data stream within said observation interval;

a plurality of decoder nodes processing said symbol estimates and producing a plurality of symbol likelihoods;

a plurality of amplitude update nodes processing said symbol likelihoods and calculating a plurality of amplitude update vectors; and

an amplitude estimator node processing said amplitude update vectors and producing an amplitude estimate update, wherein said amplitude estimate update is passed back to said processing nodes for iterative processing between said symbol processing nodes, said decoder nodes, said amplitude update nodes, and said amplitude estimator node until a final condition is obtained.

23. The system according to claim 22, further comprising a plurality of memory units, wherein at least one memory unit is coupled to each of said processing nodes and to each of said amplitude estimation nodes.

24. The system according to claim 22, further comprising a first system area network (SAN) coupling said processing nodes and said decoder nodes, a second system area network (SAN) coupling said decoder nodes and said amplitude estimation nodes, a third system area network (SAN) coupling said amplitude estimation nodes and said amplitude estimator, and a fourth system area network (SAN) coupling said amplitude estimator and said processing nodes.

25. The system according to claim 22, wherein said final condition is selected from at least one of the group consisting of: bit error rate metric level and fixed number of iterations.

26. The system according to claim 22, wherein said processing nodes, said decoder nodes and said amplitude estimation nodes are one set of nodes.

27. The system according to claim 26, wherein said one set of nodes are each comprised of at least one processor.

28. The system according to claim 22, wherein said likelihood symbols from said decoder nodes are accessible at any time for post-processing.

29. The system according to claim 22, wherein said processing nodes further comprises a thresholder to convert said symbol estimates to symbol bits.

30. The system according to claim 22, wherein said decoder nodes performs de-interleaving, rate identification, de-puncturing and de-scrambling.